Earth's Atmosphere

ES-4 The student will demonstrate an understanding of the dynamics of Earth's atmosphere.

ES-4.6 Summarize the possible causes of and evidence for past and present global climate changes.

Taxonomy level: 2.4-B Understand Conceptual Knowledge

Previous/future knowledge: Students have not been introduced to the concepts in this indicator in any previous grade.

It is essential for students to know that some years Earth may be warmer, cooler, wetter, or drier than others, but on the average during a person's lifetime, climate does not change significantly. However, in Earth history evidence shows that Earth's climate has changed and is in a constant state of change. Major climate changes take long time periods.

Ice ages A long period of climatic cooling during which continental ice sheets, glaciers, cover large areas of Earth's surface is known as an ice age, or *glacial period*. Scientists have discovered several major glacial periods during Earth history. Features such as U-shaped valleys and moraine deposits are evidence of how far ice sheets advanced during an ice age.

Interglacial Period Times of warmer temperatures between the colder glacial periods are known as interglacial periods. Earth is currently experiencing such an interval.

Cause: One theory states that possibly a small change in Earth's orbit or in the tilt of Earth's axis occurs – basically a change in the amount of solar energy reaching Earth's surface. Another theory proposes that ice ages were caused by tectonic plate motion changing the position of the continents; others propose that volcanic dust blocked the Sun's rays.

Evidence: Evidence gathered from tree rings, ice-core samples, fossils, and radiocarbon sample provide evident of past climatic changes. Evidence has also come from the ocean floor in the shells of dead marine animals.

Present short-term climate changes also occur.

El Nino El Nino is a warm ocean current that occasionally develops off the western coast of South America forming around Christmas time about every three to ten years and lasting about a year. It can cause climate changes world-wide, especially in the tropics by weakening the trade winds in that area of the Pacific. This allows warm water to flow eastward instead of its usual westerly direction, changing the cool, dry region to a warmer, wetter one. It also changes the subtropical jet stream causing unusual weather around the world.

It is not essential for students to know the details of glaciers and ice movement.

Assessment Guidelines:

The objective of this indicator is to *summarize* the cause and evidence for past and present climate changes; therefore, the primary focus of assessment should be to generalize major points about these changes.

In addition to *summarize* appropriate assessments may require students to:

- *recall* conditions on Earth during an ice age; or
- *exemplify* evidence for climate change such as ice ages.